E. A. de Schweinitz. The Importance of the Study of Biochemistry. Jour. Am. Chem. Soc., vol. xvi, p. 261.

Fifty years ago Panum of Denmark extracted from putrid organic matter chemical substances which produced intoxication and death when perfectly free from every form of germ life; but the *poison* may be produced by a *microbe*, and thus both play a part in disease.

Germs are cells of protoplasm, to the growth of which albuminoid matter is considered necessary by some, but Fermi, Uschinsky, and I myself have obtained albuminoids as well as alkaloids from germ cultures in solutions that did not contain a trace of albuminoid matter, showing that these substances have been truly built up and elaborated by the germs, and hence are to be compared to intercellular secretions and excretions of the germ cells and are not products of decomposition only. Products formed under the two conditions are similar, as shown by the same physiological action of mallein from beef broth or from artificial solutions. The chemical changes which these products undergo, by which immunity to disease is produced, are not well understood. Scholl finds that egg albumen has a germicidal power, destroyed by heat, and restored by adding alkali. His theory is that normal albumen consists of separate molecules adapted to coalesce in pairs by the action of heat with a loss of CO_2, and that coagulation is the result of this chemical change, which may also be produced by acids. In the albumen molecule, then, there is a group of atoms with a bactericidal action destroyed by heat and restored by alkali.

I. A. Davalos, of Havana, finds a distinct ferment and different germs in different varieties of tobacco, each quality of which owes its peculiar flavor and odor to some particular ferment. By substituting the germs of a fine tobacco for those of a low-grade tobacco the manufactured article is greatly improved.

The flavor and aroma of butter and cheese are due to the products of one or more bacteria. To produce the best butter and cheese only those bacteria are used which give a desirable flavor, and we may see the time when each dairy will be provided with its own bacteria farm, where they are reared with as much care as the cows that furnish the milk.

The chemist should find out what the products of the growth of these germs are. They would probably be substances capable of easy synthetic production, and thus the necessity for the aid of bacteria might be avoided.

Again, the absorption of nitrogen by plants is known to be due to nitrifying organisms, and Winogradsky has described an organism that converts the nitrogen of the air directly into nitrates. By close study of germ cultures we shall gain a better understanding of the assimilation by the plant of mineral matter, as well as the fixation of carbon, the formation of starch and sugar, and possibly the building up of alkaloids.

W. H. S.

Frederick H. Blodgett. On the development of the bulb of the adder's-tongue. Illustrated. Botanical Gazette, vol. xix.

Hundreds of small plants of *Erythronium Americanum* Ker. are found in the spring with the bulbs less than five inches below the surface of the soil, each bearing a single leaf and no flowers, while comparatively few plants bearing two leaves and a flower each are found, and bulbs of these are at depths varying from five to nine inches.

The question has been raised as to the method by which the mature bulbs reach their great depth.

Apparently the seeds germinate soon after ripening and form small bulbs not more than a quarter of an inch long near the surface of the soil. These bulbs develop a single leaf early in spring, which dies in a month or so, but meantime runners have started from the bottom of the bulb, which vary both in length and direction of growth, being from two to nine inches long and ranging from perpendicular to nearly or quite horizontal. As the supply of nourishment in the parent bulb is exhausted, the tip of the runner thickens into a secondary bulb, which sends out rootlets from the upper part, and then the runner is absorbed, leaving, in the cases examined, nothing but a dry and empty husk of the parent bulb and runner. These secondary bulbs later in the season lose their fleshly rootlets from the upper part of the bulb and send out the fibrous roots from the base.

The number of runners varies from one to three in the plants examined, and they grow in different directions. These runners are

from two to nine inches long, so that if they grew vertically the bulb might be formed at the depth of the flowering bulbs, but they run obliquely more frequently than vertically, thus leaving the secondary bulbs nearer the surface than the mature ones. The secondary bulb, after reaching the depth of the flowering bulb, does not always blossom the next spring, for bulbs with six inches of soil above them have been found with one leaf each.

On November 4 a microscopical examination of sections cut from bulbs of various ages was made. A vertical section of a mature bulb showed a sprout of a yellow color, made up of several layers running up through the flesh near one side. The outer of these layers was formed by the two foliage leaves enclosing the bud of next spring's flower. This flower bud was more than half as long as the whole bulb and its parts were well advanced. The perianth was nearly colorless, but the leaves were quite yellow. The stamens were nearly three-eighths of an inch in length, of which the anther was more than half. The anthers were filled with pollen, the grains of which were four times the size of the starch grains. The pistil was five-sixteenths of an inch in length, the ovary being one-eighth of an inch long. The projections on the placentæ from which the ovules are developed were seen and showed a dark center.

After removing the husk, the tip of a fresh specimen was seen to be made up of two modified leaves, or leaf scales, one completely surrounding the other except at the tip, where the sprout and inner scale push through. The pressure on the edges of this opening compresses the flesh on the one side of the tip, but makes it spongy on the other. These two tips, one within the other, gave the impression that the root is a true bulb, being formed of modified leaves, which was afterward confirmed by studying the sections and by comparison of the definitions of corm and bulb and the examination of examples of each.

A section cut from the bulb a quarter of an inch below the tip showed the sprout to be composed of concentric layers, which are the foliage leaves enclosing the perianth and other parts of the bud. The epidermal cells were distinguishable at the middle of the outer leaf, which completely surrounds the inner one and overlaps, but the inner one does not meet around the enclosed flower bud. This is the character of the bulb scales, the outer one overlapping at the edges, which in its altered growth have united so that there is formed a continuous layer of very starchy flesh, which varies in

thickness from one-sixteenth to three-sixteenths of an inch. The inner leaf and the inner scale agree in only partially surrounding the parts within it, and each is thinner than its outer fellow.

On examining the bulbs a quarter of an inch long, from the seeds of last spring's flowers, the leaf was merely a round yellowish body, having a line extending nearly across it, showing where the upper surface of the leaf was to be. In a bulb half an inch long the leaf is convolute and its surfaces are free from each other. In an intermediate bulb the leaf was convolute above and conduplicate near the base.

W. H. S.

THE MICHIGAN FISH COMMISSION have established a biological laboratory at Charlevoix, on the eastern shore of Lake Michigan, just north of Grand Traverse bay. It will be under the direction of Prof. Henry B. Ward, of the Nebraska University, with the cooperation of the University of Michigan, and the work is planned with especial reference to the life history of the whitefish. Scientific visitors will be welcome during July and August.